Gestational Diabetes – New Recommendations

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US Preventive Services Task Force

- "The US Preventive Task Force concludes that the evidence is insufficient to recommend for or against routine screening for gestational diabetes."
  I Recommendation. Guide to Clinical Preventive Services
  - Fair to good evidence that screening combined with diet and insulin therapy will reduce fetal macrosomia in GDM
  - Insufficient evidence that universal screening reduces important adverse health outcomes for mother or baby
  - Frequent false positives may adversely affect a mother's perception of her health
  - Choose not to screen at all, or only for "high risk" patients

6 Important Resources

- Fourth International Workshop on GDM
  - Chicago, IL, March 14, 1997, sponsored by ADA
  - Summary Statement was published in: Diabetes Care 1998;21:B161-7
- ADA Statement on Gestational Diabetes
  - Position Statement was published in: Diabetes Care 2002;25:S94-S96
- ACOG Practice Bulletin #30, September 2001
  - Clinical Management Guidelines For Obstetricians-Gynecologists *(Replaces Technical Bulletin Number 200, December 1994)*
- US Preventive Services Task Force Recommendation 2002
- American Association of Endocrinologists – 2003
  - Statement about blood glucose levels for inpatients
- ADA Position Statement on Preconception Care of Women with Diabetes – Diabetes Care 2004;27:276-9.

Other Governing Bodies

- ADA:
  - Screen all women at risk
  - >25yrs, obese, high risk ethnic group, family hx, poor obstetric outcome
- ACOG Practice Pattern 2001:
  - Risk based approach
  - States that since so few people have no risk factors a universal screening program may be more practical
- Canadian Task Force 1991:
  - No evidence for or against screening

The Dissenting Opinion

- Significance of the condition is controversial:
  - Insulin resistance is normal in all pregnancies to some extent – is this a disease state?
  - Does the degree of hyperglycemia in GDM really represent a true risk to the mother?
- There are no evidence-based studies showing that prevention and rigorous treatment of GDM minimize maternal or fetal complications
- Given the ethical and medico-legal climate these studies are unlikely to be undertaken

American Association of Endocrinolgists (AACE)

- Statement issued for inpatient management
- Endorsed by AACE, ACE, and ADA
- Sets SOC for inpatient Mx of diabetes
- Addresses pregnancy:
  - 110mg/dl is upper limit in ICU
  - 180mg/dl is upper limit on non-critical care units
  - Prelabor pregnancy: 100 mg/dl preprandial and 120 mg/dl at 1 hour postprandial (cf: ACOG)
  - During labor and delivery: 100mg/dl is upper limit
  - Strict glycemic control during labor improves neonatal outcome
- The document is on the web:
  http://www.aace.com/clin/guidelines/InpatientDiabetesPositionStatement.pdf

If you don't accept that GDM is a problem…….

- 2 X increased risk for PIH
- Macrosomia in up to 40% of GDM offspring
- Significantly increased risk of shoulder dystocia in macrosomic babies
- Increased polyhydramnios, preterm delivery and cesarean section in GDM
- Increased admission to NICU

Sendag et al. JRM 2001;46:1057-62 (Level II-2)

Offspring of Women with GDM

- Increased risk of diabetes and obesity by puberty BUT this risk is not related to birthweight
- Breast feeding may reduce obesity in offspring
- Potential for **neurobehavioral abnormalities** in offspring of poorly controlled GDM….BUT data are few and follow-up studies are needed
- Offspring of women with GDM may be more likely to have children with diabetes
- 33% of offspring of women with GDM only have glucose intolerance as adults

If you don't accept that GDM is a problem…….

- "Gestational Diabetes: The consequences of not treating. "Langer et al. AJOG 2005:192;989-97
- 555 untreated GDM patients after 37 weeks matched with 1110 treated GDM patients and 1110 non-diabetic control
  - Matched for delivery year, obesity, parity, ethnicity, GA, # prenatal visits
- Used a composite adverse outcome:
  - Stillbirth, macrosomia/LGA, hypoglycemia, erythrocytosis, hyperbilirubinemia

Langer et al. AJOG 2005:192;989-97 (Level II-2)

Glucola – Discounted?

- Medical College of Virginia Hospital 1991-2002
- 1OGTT > 140mg% followed by 3GTT
  - Used NDDG criteria and compared with CC
- ROC curves generated
  - 16 898 patients studied – 2770 (16.4%) > 140mg%
  - 1972 patients with both 1OGTT and 3GTT had GDM diagnosed by both NDDG (21%) and CC (31%)
- Predictive value of 1OGTT was very low – a cut-off of 200mg% predicted only 47-54% of GDM cases
- Conclusions: Inappropriate to use 1OGTT for screening GDM

Lanni and Barrett. J Mat Fetal Neonat Med 2004;15;375-9 (Level II-2)

If you don't accept that GDM is a problem…….

- Results:
  - Composite adverse outcome:
    - 59% for untreated women
    - 18% for treated
    - 11% for non-diabetics
- Macrosomia/LGA and metabolic complications:
  - 200 – 400% increase in untreated GDM vs treated and non-diabetics
  - No difference between treated and non-diabetic patients
- Comparison of maternal size/parity and disease severity showed a 200 – 300% increase in morbidity in untreated GDM versus treated and non-diabetic

Langer et al. AJOG 2005:192;989-97 (Level II-2)

1 Abnormal value on 3 hr GTT

- One abnormal value on 3 hour GTT:
  - Increased risk for fetal macrosomia

    Langer et al. Am J Obstet Gynecol 1989;161-593 (Level II-1)
  - If test is repeated 30% will subsequently show GDM

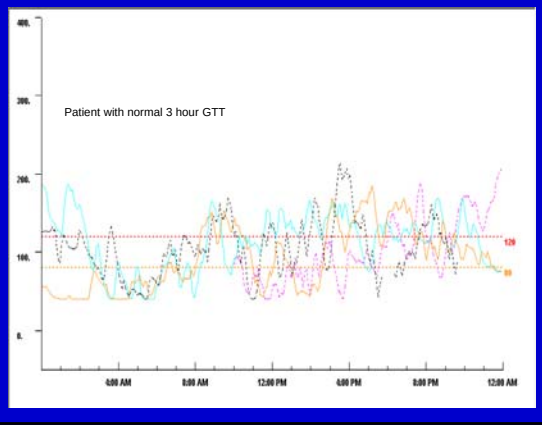
    Neiger et al. Am J Obstet Gyneol 1991;165-787 (Level II-3)
- Current testing may be insufficient:
  - 2 hour values between 120-165 mg/dl are associated with macrosomia, anomalies, preeclampsia and increased cesarean section rate

    Tallerigo et al. NEJM 1986;315-989 (Level II-2)

Early Screening for GDM

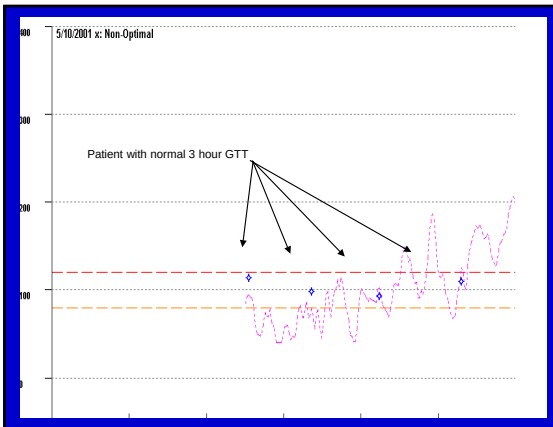
- To determine the accuracy of the glucola at 16 weeks in identifying GDM
- 255 patients, 1hr glucola at 16 weeks
  - If > 135 mg/dl they had a 3hr GTT
  - If < 135 mg/dl they had repeat testing in third trimester
- 25/255 got GDM
  - 16 week testing identified 96% (24/25)
  - A positive 16 week test gave a PPV or 55% (vs. 22% in 3rd trim)
  - If the 16 week value was < 110 mg/dl there was 99.4% NPV
  - If the 16 weeks test was 110 – 134 mg/dl the NPV was 96.2%

Nahum et al. JRM 2002;47;656-662 (Level II-3)



Target Plasma Glucose Levels in Pregnancy (whole blood)

Fasting	60 – 90 mg/dl
Preprandial	60 – 105 mg/dl
1 hr Postprandial	< 140 mg/dl
2 hr Postprandial	< 120 mg/dl
2 am to 6 am	60 – 90 mg/dl



Postprandial Glucose Profile

- 65 patients (26 A1, 19 A2, and 20 Type 1)
- Monitored continuously for 72 hours
- Meal to peak postprandial level was 90 minutes and was similar for breakfast, lunch, or supper
- 50% of patients failed to return to baseline within 3 hours
- Hypoglycemia in 10% of patients (mean 160 min)

Ben-Haroush et al. Am J Obstet Gynecol 2004;191:576-81

Target Plasma Glucose Levels in Pregnancy (plasma)

- Fasting 70 – 105 mg/dl
- Preprandial 70 – 120 mg/dl
- 1 hr Postprandial < 155 mg/dl
- 2 hr Postprandial < 130 mg/dl
- 2 am to 6 am 70 – 105 mg/dl

Accucheck Plasma

In-Duo plasma

What Meter are They Using??

- Whole Blood Meters:
  - Old fashioned
  - Take about 45 seconds to read BG
  - Need very accurate sized drop of blood
  - "One Touch Profile"
- Plasma Meters:
  - New and improved
  - Much quicker and more convenient
  - Different type of strip
  - "One Touch Ultra, Surestep, Freestyle, Accucheck"

Insulin Administration

- Fasting level greater than 95 mg/dl (whole blood) or 105 mg/dl (plasma)
- Postprandial > 120 mg/dl (whole blood) or 130 mg/dl (plasma) at 2 hours and 130-140 mg/dl (whole blood) or 155mg/dl (plasma) at 1 hour
- Fetal Macrosomia
- Abdominal Circumference > 75th% at 29-33 weeks
- Polyhydramnios??
- No recommendation on how long to try diet
  - 2 weeks if initial fasting level < 95 mg/dl
  - ? If initial fasting level > 95 mg/dl – perhaps go straight to insulin
- No particular insulin regimen better than any other

One-Touch Profile
Venous Blood

One-Touch Ultra
Plasma meter

Newer Insulins

- There are a number of newer preparations available:
  - Lantus (long acting – once daily dosage)
  - Humalog (short acting - ~5 hrs, active within 15 minutes)
  - Novolog
- These are not specifically approved for use in pregnancy BUT their use is widespread and there have not been any reports of bad outcomes
- Actually, the FDA has not approved ANY insulin specifically for use in human pregnancy

Lantus - Issues

- Cannot be combined with any other insulin since it precipitates out and loses its duration of action
- In GDM a single daily shot of Lantus is often all that is needed
- Is marketed for bedtime use BUT often get better results when used in am (especially if in cases where there is night-time hypoglycemia)
- Duration of action is 20 – 24 hours ("poor woman's pump")

New Insulin – Short Acting

	Onset	Peak	Duration
Humalog	10 – 15 minutes	0.75 – 2 hours	4 – 5 hours
Novolog	10 –15 minutes	1 – 3 hours	3 – 5 hours

Lantus - Dosing

- No absolute recommendations – BUT we use:
- Never used insulin before:
  - -10 units at bedtime
  - Increase dose in 2 – 4 unit increments for elevated fasting
- Switching to Lantus from other insulin:
  - 80% of long acting insulin (NPH/ultralente/lente)
  - Increase dose in 2 – 4 unit increments for elevated fasting

Shorter Acting Insulins - Issues

- Shorter acting insulins do not cross the placenta
- No data to suggest that they are more immunogenic than longer acting insulins
- Recent large multicenter study did not show any increase in congenital abnormality rate with new shorter acting insulins

Lantus - Issues

- Long acting insulins do not appear to be mitogenic in humans
- May bind to IGF receptors when given in high doses (Diabetes 2000;49:999-1005)
- Not enough data to be certain that there is no immunogenicity
- Should inform patients of this information
- Some people recommend waiting for more data prior to using these agents in pregnancy

Patients best for NPH/Regular

- Lifestyle:
  - regimented lifestyle (fixed schedule)
- Diet:
  - Carbohydrate goals (i.e. 45 grams CHO per meal) rather than CHO counting
- Complexity Issues:
  - Unable/unwilling to master carbohydrate counting
- Number of shots per day:
  - Prefer BID or TID dosing

Patients best for Lantus and Novolog/Humalog

- Lifestyle:
  - prefer flexible schedule, skipping meals/snacks
- Diet:
  - Have to know how to count CHO
- Complexity Issues:
  - Can master carbohydrate counting and calculate ratios
- Number of shots per day:
  - Do not mind at least 4 – 10 shots per day

Insulin Pump in Pregnancy

- Few data
- One small study suggests that there may be better glycemic control at beginning of pregnancy
- Retropsective study of 13 patients comparing them to their prior pregnancy without a pump
  - HbA1c was 6.7 +/- 1.2 versus 8.3 +/- 2.4 % (p <0.05)
- Need larger studies to confirm this finding

Mostello et al. Obstet Gynecol 2002;99:22S

Dosing for Lantus and Novolog/Humalog

- Calculating the insulin needs:
  - 0.7U/kg/day in first trimester, 0.8U/kg/day in the second, and 0.9 – 1.0 U/kg/day in the third trimester
- Usually split needs 2/3 in the am and 1/3 in the pm
  - split am and pm doses 2/3 and 1/3 as NPH and regular
- With Lantus its different:
  - take total daily dose and split it 50% as Lantus at bedtime and then give humalog/novolog as per carb counting ratio
  - Starting ratio is 1U/15grams CHO (if postprandials are elevated go to 1:12 or 1:10 and adjust from there
  - High sugar correction before every meal and 2 hours postprandial – 1U per 50mg/dl > 150 mg/dl

Oral Hypoglycemic Agents

- 5 Different Classes
  - Sulfonylureas (increase insulin secretion)
  - Non SU secretogogues (increase insulin secretion)
  - Biguanides (decrease hepatic gluconeogenesis)
  - “-Glucosidase Inhibitors (delay GIT CHO absorption)
  - Thiazolidinediones (increase glucose uptake, decrease lipolysis)

Troubleshooting Lantus and Novolog/Humalog

- If the fasting levels are high:
  - increase bedtime Lantus dose (2 – 4U)
- If 2 hour postprandial is high
  - assess carb counting skills
  - Adjust carb ratio
- Blood correction factor:
  - If preprandial levels are high increase Lantus
  - If postprandial levels are high adjust carbs/ratio

Oral Hypoglycemic Agents

- 5 Different Classes
  - Sulfonylureas (glyburide, glipizide, glimepiride)
  - Non SU secretogogues (nateglinide, repaglinide)
  - Biguanides (metformin)
  - “-Glucosidase Inhibitors (acarbose, miglitol)
  - Thiazolidinediones (troglitazone)

Glyburide VS Insulin in GDM

- 404 singleton GDM gestations
- Eligible if their fasting glucose > 95 mg/dl or if they failed diet control
- Randomized between 11 – 33 weeks
- Glyburide vs intensive insulin protocol
- Primary objective: glycemic control
- Secondary objective: maternal/neonatal complications

Langer et al. NEJM 2000;343:1134-8

Glyburide VS Insulin: Results

- 197 patients enrolled – 124 diet, 73 glyburide
- 59/73 (81%) achieved satisfactory control with glyburide alone
- 44/73 (60%) needed 7.5 mg/day or less
- 11/59 (19%) with glyburide alone had macrosomia
- 8/59 (11%) had noticeable side effects but only 1 stopped therapy

Kremer CJ, Duff P. AJOG 2004;190:1438-9

Glyburide VS Insulin: Results

- Pretreatment glucose levels were similar in both groups
- Mean glucose concentrations were similar in both groups during treatment (105 ✐ 16 [gly] vs 105 ✐ 18 [ins] mg/dl)
- Only 4% (8 patients) in glyburide group needed insulin
- No severe side effects from glyburide
- Similar levels of cord insulin
- No glyburide detected in cord serum

Langer et al. NEJM 2000;343:1134-8

Conclusion

In women with gestational diabetes glyburide is an effective alternative to insulin therapy

Glyburide VS Insulin in GDM

- 197 singleton GDM gestations
- Only eligible if they failed diet control
- Treated with Glyburide starting at 2.5mg daily and increasing to maximum 20mg/day
- Primary objective: glycemic control as defined by fasting < 90mg% and 1hr PP < 135mg%
- If they failed they were treated with insulin

Kremer CJ, Duff P. AJOG 2004;190:1438-9

Followup Study – NADP Study Group

- **Clinical setting:**
  - 60 women diagnosed with GDM at 11-33 weeks
  - All had a low CHO diet
  - Only started if they failed the diet
  - Changed regimen to allow twice daily dosing if necessary (2.5 mg, am [and pm if needed])
  - 75% were successfully controlled with glyburide
  - 15% of patients needed insulin
  - 12% delivered macrosomic babies
  - Fasting glucose of 121mg% and BMI 41.6 were cutoff levels below which glyburide was successful (~50% sensitive, ~90% specific)

Conway et al 2003

San Antonio Experience

- **Clinical setting:**
  - 75 women treated with glyburide
    - achieved glycemic control (84%)
    - no glycemic control (16%)
  - ROC curves – cutoffs for fasting glucose level and BMI that would predict glyburide failure
  - **Results:**
    - Glyburide failures had higher 3hr GTT levels at all time points
    - No cutoff points for glyburide failure noted
    - Fasting glucose of **≥ 110** mg% 24% failed versus 12% if Fasting glucose was < 110 mg%

Conway et al. J Matern Fetal Neonatal Med 2004;15:51-5

Allergies

- Glyburide should not be given to patients with:
  - Allergy to sulpha drugs
  - Allergy to sulphonamide drugs
- It is a substrate for the cytochrome p450 enzyme system (CYP3A) – interactions:

- CYP3A Inhibitors: SSRI's, cimetidine, Azoles (diflucan), erythromycin, proteases – will increase glyburide effect

- CYP3A Inducers: carbamezapine, dexamethasone, phenytoin, rifampin – will decrease glyburide effect

Symptomatic Hypoglycemia

- **Continuous Glucose monitoring 72hrs**
  - 82 with GDM (30 insulin, 27 diet, 25 glyburide)
  - 35 non-diabetic pregnant women (controls)
  - Hypoglycemia = 30 mins of < 50 mg/dl (No Sx's)
- **Results:**
  - 19/30 insulin (63%)
  - 7/25 glyburide (28%)
  - 0 patients on diet only or non-diabetic gravidas
  - Mean # episodes per day:
    - insulin (4 +/- 2) versus glyburide (2+/-1) p = 0.03
    - insulin 84% events nocturnal, glyburide 50%

Yogev et al. Obstet Gynecol 2004;104:88-93

What About Metformin?

- Increased use of metformin in infertility treatment
- Facilitates ovulation in women with PCOS and decreases abortion rate
- South African data (Jackson and Coetzee) did not show any increased complications or teratogenicity
- May prevent development of GDM

Glyburide Problems?

- **Large Managed Care Organization:**
  - adopted a policy of using glyburide in 2001
  - compared 236 (glyburide: 2001-02) vs. 268 (insulin: historical control group 1999-2000)
- **Results:**
  - Insulin group had higher:
    - BMI (32 vs 30; p =0.04), more caucasians
    - fasting level (107+/-14 vs. 99+/-13; p<0.001)
    - 1 hr PP level (143+/-27 vs 140+/-26; p<008)
  - Glyburide group had:
    - lower post treatment fasting and 1 hr pp levels
    - more preeclampsia (12% vs. 6%; p =0.02)
    - more neonatal phototherapy (9% vs. 5%; p=0.046)
    - less NICU admissions – 15% vs 24%; p=0.008)

Ramos et al. Am J Obstet Gynecol 2004;191:S53(#158) level 11-2

What About Metformin and GDM?

- Small US study:
  - 33 non-diabetic women with PCOS
    - (28/33 took Metformin until delivery)
    - (12 had prior pregnancies without Metformin)
  - 39 non-diabetic women with PCOS (controls)
    - studied in 60 pregnancies
- Results
  - Most patients in both groups were very obese (33 Kg/m2)
  - Metformin Group:
    - 1/33 (3%) got GDM (vs. 8/12 (67%) in a prior pregnancy)
    - significant drop in BMI, insulin level/secretion/resistance
    - no teratogenicity
  - Control Group:
    - 14/60 (23%) got GDM

Glueck et al. Fertil Steril 2002;77:520-5 (Level 11-2)

What About Metformin and SAB?

- Retrospective US study:
  - 96 women with PCOS
    - 65 took Metformin in early pregnancy
    - 31 did not take Metformin (controls)

Results

- All patients:
  - * SAB occurred in 8.8% of Metformin group and 41.9% of Controls ($p < 0.001$)
- Patients with a prior miscarriage:
  - SAB occurred in 11.1% of Metformin group and 58.3% of Controls ($p < 0.001$)

Jakubowicz et al. J Clin Endocrinol Metab 2002;87:524 (Level 11-2)

Metformin vs. Insulin - RCT

- Prospective RCT:
  - 63 patients with A2 diabetes
  - exclusion: IDDM, liver/kidney dz, CHTN and Sz disorder
  - inclusion: > 11weeks < 36 weeks
  - Insulin: 0.7U/kg/day or Metformin 500mg BID
  - Aim: fasting 60-90 mg%, 2 hr pp < 120 mg%

Results:

- 31 received Insulin and 32 received Metformin
- Demographics were similar
- Those on Metformin were heavier than Insulin (229+/-56 vs 199+/-43 lbs: p = 0.016)
- No difference in diabetic control – all within the limits
- No difference in CS rate, EGA at delivery, shoulder dystocia, post partum hemorrhage, neonatal outcomes

Moore et al. Am J Obstet Gynecol 2004;191:S8 (A#17) (Level 1)

What About Metformin and Problems?

- Cohort Prospective Danish study:
  - 118 women pregnant diabetic women
    - 50 took Metformin throughout the pregnancy
    - 68 received a sulphonylurea
    - 42 received insulin during the pregnancy

Results

- Preeclampsia:
  - significantly higher incidence in Metformin group compared to sulphonylurea and insulin (32% vs. 7% vs 10%; $p < 0.001$)
- Perinatal mortality:
  - significantly higher in Metformin treated versus no metformin (11.6% vs. 1.3%; $p < 0.02$)
- No differences in neonatal morbidity between any groups

BUT: Metformin patients were older and had much higher BMI

Hellmuth et al. Diabet Med 2001;18:604 (Level 11-1)

What to do about Metformin?

- Current Recommendations:
  - do not start Metformin in pregnant patients
  - consider enrolling patients in RCT's to determine the usefulness and risks of this drug
  - if someone is on Metformin and does not have PCOS stop the drug if they get pregnant
  - if someone is already on Metformin and has PCOS the risk benefit ratio and the minimal data can be presented and she can make her informed choice

Metformin and Preeclampsia

- Prospective Case-Control USA study:
  - 90 PCOS women who got pregnant on Metformin
  - 252 normal healthy pregnant women
  - consecutive deliveries in community hospital

Results

- PCOS women were older, heavier, and more likely to be Caucasian ($p < 0.05$)
- similar numbers with preconception Type II diabetes (2.2% vs 0.4%; p = NS)
- No differences in incidence of:
  - preeclampsia (5.2% PCOS vs 3.6% Controls; p = NS),
  - GDM 10% vs 16% (p = NS)
- No differences in neonatal morbidity, macrosomia

Glueck et al. Diabet Med 2004;21:829 (Level 11-1)

α-glucosidase inhibitors

- prevent pancreatic and intestinal α-glucosidase
- slow down duodenal/jejunal absorption of sugars
- prevent breakdown of oligo- to monosaccharides
- decrease postprandial blood glucose levels
- can be given with insulin or oral agents
- not very effective in people on low CHO diets

Acarbose

- 2 drugs: Acarbose (not absorbed), Miglitol (absorbed)
- Acarbose
  - 50 - 100mg PO TID (start 25mg TID)
- May cause gas, cramping, diarrhea, elevated LFT's
- Pregnancy category B
- Only 2 published studies in GDM:
  Zarate et al 2000 – 6 patients - significant GI side effects
  De Veciana et al 2002 – 56 patients – good outcome

Thiazolidinediones

- Decrease peripheral glucose resistance
- Act by gene transcription to activate nuclear receptors that increase peripheral glucose uptake
- May be combined with insulin or oral agents
- Pregnancy category C (but are contraindicated)
- May cause hepatotoxicity (troglitazone withdrawn)
- 2 drugs available: rosiglitazone and pioglitazone

Acarbose VS Insulin

- 56 GDM who failed diet (1800-2000 cal/day) started on 25mg acarbose TID and increased to 100mg as needed
- 54 control GDM patients received insulin
- No differences in outcomes: demographics, BW, duration of Rx, glucose levels, GA, or CS rate
- Acarbose group used 125mg/day at term and Insulin group used 43U insulin per day at term
- 3 women on acarbose switched to insulin: 1 d/t GIT side effects and 2 d/t failure to control glucose level

De Veciana et al. Obstet Gynecol 2002 (abstract)

ACOG Perspective – 2001 Bulletin

" At this time, no other oral agent has been shown to be safe and effective in GDM, and [the Langer] study has not been confirmed. Further study is recommended before the use of newer oral hypoglycemic agents can be supported for use in pregnancy."

Acarbose VS Diet

- Currently a RCT study is underway at UC San Diego looking at diet versus diet + acarbose
- Goal is to reduce patients who need insulin or glyburide
- Acarbose delays absorption of CHO and is expected to lower postprandial glucose levels but not affect fasting levels

Moore et al. University of San Diego

ADA 2001 Summary Statement

" Glyburide is not FDA approved for the treatment of gestational diabetes and further studies are needed in a larger patient population to establish its safety"

Perinatal Implications of GDM

- With appropriate glucose control IUFD in GDM is similar to that in normal pregnancy
- Antenatal monitoring not needed until 40 weeks if well controlled – start at 32 weeks if poorly controlled
- Major fetal issue is macrosomia and its complications
- Maternal hyperglycemia may not be the only important factor for macrosomia – amino acids, growth factors, lipids are also important
- Fasting < 90 mg/dl, 1 hr <140 mg/dl, and 2 hr <120 mg/dl decreased macrosomia (postprandial levels most NB)

Diabetes care 1998;21-B161-7

Management in Labor/Postpartum

- Insulin Pump in labor:
  - Fine to use it in labor in combination with IV dextrose
- Lantus/Humalog in labor
  - No data
  - Probably switch to insulin protocol for that institution
- Glyburide in labor:
  - Stop the night before
  - Use insulin protocol at the institution

Timing of Delivery

- GDM alone is not an indication for C/S, or for delivery < 38 wks unless there is fetal compromise (ACOG and ADA)
- There are some data to suggest that delivery at 38 weeks may reduce macrosomia and cesarean section rates (ADA)
- ADA states "delivery during the 38th week is recommended"
  ACOG does not support this statement
- No strong data to suggest that perinatal M + M is increased after 40 weeks in well controlled GDM…BUT intensified fetal surveillance is still recommended (ACOG)

Management in Labor/Postpartum

- Target range:
  - 80 – 120 mg/dl (plasma), 70 – 110 mg/dl (capillary)
  - Check levels q 1 – 4 hours during labor
- Insulin should only be given if glucose exceeds these levels – avoid routine insulin administration
- Elective C/S: no insulin unless high fasting level
- Parenteral glucose recommended at a dose of 0.12 – 0.18g/Kg/hr (125 ♓ 200 cc LR/D5W/hr)
- Patients with GDM rarely need postpartum insulin

Diabetes Care 1998;21:B161-7